

## CLAIMS

1. An external pressure type hollow fiber membrane module comprising a hollow fiber membrane bundle formed of a plurality of hollow fiber membranes, a housing, and a nozzle for allowing a fluid to enter and exit therefrom, which makes the hollow fiber membranes fixedly adhered to each other and to the inner wall of the housing at both ends of the hollow fiber membrane bundle; makes a hollow part opened in one side or both sides of adhesively-fixed ends; and has the nozzle for allowing the fluid to enter and exit therefrom installed on the side face of the housing of at least one adhesively-fixed end at which the hollow part is opened; wherein a ratio  $PB/PA$  of membrane-occupying rates is 0.50 or more but 0.95 or less when each of  $PA$  and  $PB$  is defined as the membrane-occupying rates in a neighboring region (A) of the nozzle and a non-neighboring region (B) of the nozzle among a membrane chargeable region in the inner side of an adhesively-fixed part, in at least one adhesively-fixed end of the opened hollow part in the vicinity of the nozzle.

2. An external pressure type hollow fiber membrane module comprising: a hollow fiber cartridge having a hollow fiber membrane bundle formed of a plurality of hollow fiber membranes, of which both end parts are adhesively fixed and hollow parts in at least one end of adhesively-fixed ends are opened; and a

housing accommodating the cartridge and having a nozzle for allowing a fluid to enter and exit therefrom installed on at least one side face, in which the nozzle installed is fixed so as to be placed in the vicinity of the inner surface of an adhesively-fixed part in the opened hollow parts side in the hollow fiber membrane cartridge; wherein a ratio PB/PA of membrane-occupying rates is 0.50 or more but 0.95 or less when each of PA and PB is defined as the membrane-occupying rate in a neighboring region (A) of the nozzle and a non-neighboring region (B) of the nozzle among a membrane chargeable region in the inner side of the adhesively-fixed part, in an adhesively-fixed end in the vicinity of the nozzle.

3. The external pressure type hollow fiber membrane module according to claim 1 or 2, wherein in the neighboring region (A) of the nozzle, among a membrane chargeable region in the inner side of an adhesively-fixed part, membrane occupying-rate PC is 0.5 times or more but 2.0 times or less with reference to membrane-occupying rate PA in the neighboring region (A), in every unit region (C) constituting the neighboring region (A).

4. The external pressure type hollow fiber membrane module according to claim 1 or 2, wherein PA, PB1 and PB2 of the membrane-occupying rates have the relation of  $PA \geq PB1 \geq PB2$  and further PA is 0.40 or more but 0.60 or less and PB2 is 0.20 or more but less

than 0.40 when each of PB1 and PB2 is defined as a membrane-occupying rate in a first non-neighboring region (B1) and a second non-neighboring region (B2) in the non-neighboring region (B) of the nozzle among the membrane chargeable region in the inner side of an adhesively-fixed part.

5. The external pressure type hollow fiber membrane module according to any one of claims 1 to 3, wherein the non-neighboring region (B) of the nozzle among the membrane chargeable region in the inner side of an adhesively-fixed part includes at least one unit region in which membrane-occupying rate PC in unit region (C) constituting the non-neighboring region (B) is less than 0.5 times with reference to the membrane-occupying rate PB in the non-neighboring region (B).

6. The external pressure type hollow fiber membrane module according to claim 1 or 2, wherein a current plate is arranged in the vicinity of the nozzle of outer circumference parts of the hollow fiber membrane bundle.

7. The external pressure type hollow fiber membrane module according to claim 6, wherein the current plate is cylindrical, accommodates the hollow fiber membrane bundle inside of it, has a plurality of through-holes in a wall surface except the vicinity of the nozzle, and has no through-hole in the vicinity of the nozzle.

8. The external pressure type hollow fiber

membrane module according to claim 1 or 2, wherein an adhesive bond part constituting the adhesively-fixed part is made of a single layer of a high polymer material, and has the hardness of 50A to 70D in a range of operating temperatures.

9. A method for manufacturing the external pressure type hollow fiber membrane module according to claim 1 or 2 including: previously inserting a plurality of columnar materials into an end of a hollow fiber membrane bundle at least in a side of making a hollow part opened; accommodating the hollow fiber membrane bundle which keeps the state of the insertion in a vessel for forming an adhesively-fixed part; injecting an adhesive bond into the vessel and curing it; then cutting an end face of the hollow fiber membrane bundle to form the adhesively-fixed part; and consequently making the columnar materials having a length of 0.3 to 0.9 times with reference to a thickness of the adhesively-fixed part exist at least in the adhesively-fixed part of a neighboring region (A).

10. A method for manufacturing the external pressure type hollow fiber membrane module according to claim 1 including: accommodating a hollow fiber membrane bundle in a housing case having a nozzle for allowing a fluid to enter and exit therefrom at least on one side face; horizontally rotating the housing case in a state of keeping the nozzle directing toward

a lower direction than a horizontal direction;  
injecting an adhesive bond into the housing case under  
the centrifugal force; and curing it to form an  
adhesively-fixed part.